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Habitats and Distributions of the Japanese Urothripine Species (Thysanoptera, Phlaeothripidae)

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Abstract The distribution patterns of urothripine Thysanoptera species in certain habitats in Japan appear to suggest some form of competitive exclusion. Eight species of the phlaeothripine tribe Urothripini¹⁾ are here recorded from Japan, seven *Stephanothrips* and one *Baenothrips*. Of these, four are illustrated and described as new, and one is newly recorded from Japan. A key is provided to identify the eight species; *Stephanothrips boninensis* sp. n., *S. formosanus* OKAJIMA, *S. japonicus* SAIKAWA, *S. metaleucus* sp. n., *S. miscanthi* KUDÔ, *S. occidentalis* HOOD & WILLIAMS, *S. yaeyamensis* sp. n. and *Baenothrips ryukyuensis* sp. n.

Key words: Thysanoptera; Urothripini; *Baenothrips*; *Stephanothrips*; habitat; distribution.

Introduction

The insects belonging to the tribe Urothripini of the family Phlaeothripidae have a highly specialized body form. Their wings are usually absent, their legs short, and their tubes are conspicuously elongate. Their strongly tuberculate heads usually have prominent setae on the frontal costa, and their antennae are short with variously specialized fusions of the segments. It is usually considered that this kind of body form results from adaptation to their habitats, but the habitat of each species is not necessarily clear.

Prior to this study, only three species of this tribe have been recorded from Japan, *Stephanothrips japonicus* SAIKAWA, *S. miscanthi* KUDÔ and *S. occidentalis* HOOD & WILLIAMS. In contrast, this study is based on more than 1,500 specimens of eight species collected by the author and his colleagues, together with detailed habitat data, mainly from the subtropical areas of the Ogasawara and Ryukyu Islands. This material includes four species new to sciences and one new to Japan. During this investigation, the habitats of seven species have become clear, although the eighth species, *S. miscanthi*, is known only from a single specimen and the habitat of this species remains unclear.

The objective of this paper is to describe the Japanese urothripine fauna, and to provide the means for identifying the eight species. The author also discusses the habitat and distribution of each species.

Type-preservations. All holotypes and most paratypes of the new species will

1) BHATTI (1992: 152) treated this group as the Family Urothripidae.

be deposited in the Laboratory of Entomology, Tokyo University of Agriculture.

Abbreviations. The following abbreviations are used for the collectors: SO, S. OKAJIMA; TN, T. NONAKA.

Habitats and Habitat Segregation

The tribe Urothripini is found particularly in the tropics and subtropics. In North America one species extends as far north as Illinois (STANNARD, 1968), and in the warmer parts of southern Europe several species have been recorded. In Japan, eight species are found, in which two species are found in the temperate region, and one of these two also found in the subtropical region. The remaining six species are found only from the subtropical region.

In the Ogasawara Islands, four *Stephanothrips* species have been found on

Table 1. Habitats of *Stephanothrips* species in Haha-jima Is., Ogasawara Islands.

| Species | | Habitat | | | |
|---|---|-------------|---------|---------------|--------|
| | | Leaf-litter | grasses | dead branches | others |
| <i>Stephanothrips formosanus</i> OKAJIMA | ♀ | | | 9 | |
| | ♂ | | | | |
| <i>Stephanothrips occidentalis</i> HOOD & WIL. | ♀ | | | 136 | *2 |
| | ♂ | | | | |
| <i>Stephanothrips metaleucus</i> sp. nov. | ♀ | 90 | 3 | 5 | |
| | ♂ | 39 | | 1 | |
| <i>Stephanothrips boninensis</i> sp. nov. | ♀ | | 224 | 36 | *15 |
| | ♂ | | 49 | 2 | |

* collected on dead *Livistona chinensis* fronds (Palmae).

Table 2. Habitats of urothripine species in Ishigaki-jima Is., Ryukyu Islands.

| Species | | Habitat | | | |
|---|---|-------------|---------|---------------|--------|
| | | Leaf-litter | grasses | dead branches | others |
| <i>Stephanothrips japonicus</i> SAIKAWA | ♀ | 137 | | 1 | |
| | ♂ | 56 | | | |
| <i>Stephanothrips occidentalis</i> HOOD & WIL. | ♀ | 3 | 12 | 169 | *7 |
| | ♂ | | | | |
| <i>Stephanothrips yaeyamensis</i> sp. nov. | ♀ | 297 | | | |
| | ♂ | 354 | | | |
| <i>Baenothrips ryukyuensis</i> sp. nov. | ♀ | | 590 | 12 | *20 |
| | ♂ | | 74 | 3 | *1 |

* collected on dead *Arenga engleri* fronds (Palmae).

Table 3. Habitats of urothripine species in Kenting National Park, southern Taiwan.

| Species | | Habitat | | | |
|---|---|-------------|---------|---------------|--------|
| | | Leaf-litter | grasses | dead branches | others |
| <i>Stephanothrips kentingensis</i> OKAJIMA | ♀ | 24 | | | |
| | ♂ | 34 | | | |
| <i>Stephanothrips occidentalis</i> HOOD & WIL. | ♀ | | 134 | 52 | |
| | ♂ | | | | |
| <i>Stephanothrips formosanus</i> OKAJIMA | ♀ | | | 1 | |
| | ♂ | | | | |
| <i>Bradythrips hesperus</i> HOOD & WIL. | ♀ | | | 1 | |
| | ♂ | | | | |

Table 4. Habitats of *Stephanothrips* species in Honshu Is., mainland of Japan.

| Species | | Habitat | | | |
|--|---|-------------|---------|---------------|--------|
| | | Leaf-litter | grasses | dead branches | others |
| <i>Stephanothrips japonicus</i> SAIKAWA | ♀ | 924 | *198 | | **11 |
| | ♂ | | | | |
| <i>Stephanothrips miscanthi</i> KUDÔ | ♀ | | *** (1) | | |
| | ♂ | | | | |

* including bamboo grass.

** collected by yellow pan trap.

*** from the original description (KUDÔ, 1978).

Haha-jima Island. They are *S. boninensis* sp. nov., *S. formosanus* OKAJIMA, *S. metaleucus* sp. nov. and *S. occidentalis* HOOD & WILLIAMS (Table 1). Two of these, *formosanus* and *occidentalis*, occur on dead branches, *metaleucus* usually occur in leaf-litter, whilst the fourth species, *boninensis*, usually occur in grass tussocks but sometimes on dead branches. Thus their habitats seem to be quite distinct.

On Ishigaki-jima Island, the Ryukyu Islands, three *Stephanothrips* species and one *Baenothrips* species have been found (Table 2). *S. japonicus* and *S. yaeyamensis* always occur in leaf-litter, but they are rarely collected from the same sample and thus seem to be spatially segregated from each other. In contrast, *S. occidentalis* usually occurs on dead branches and is rarely taken in grass tussocks or in leaf-litter, whereas *B. ryukyuensis* is found in grass tussocks and rarely occurs on dead branches. Particularly interesting is the fact that *occidentalis* is common in grass tussocks in Kenting National Park, southern Taiwan, where there are no other grass-living urothripine species (Table 3).

Finally, on the main island of Japan, Honshu, two species have been found (Table 4). *S. miscanthi* is known only from a single female collected in Iwate Prefecture, northern Honshu, but *japonicus* is widespread on this island. The latter

species can be found on cool-temperate zone of northern end of Honshu as well as mountainous areas of the midland of this island ca. 1,000–1,500 m altitude, and it overwinters occasionally under the snow. In contrast to the habitat it occupies on Ishigaki Island, *japonicus* on Honshu is found in both leaf-litter and grass tussocks. Particularly in the rainy season, many individuals of this species move from the leaf-litter to grass tussocks and this seems to be refuge from the high humidity in the leaf-litter (H. URUSHIHARA, Pers. comm.). This may be associated with the absence of any other grass-living urothripine species on Honshu, whereas there is such a species, *B. ryukyuensis*, on Ishigaki-jima Island.

MOUND (1992: 9) pointed out that the sexual dimorphism is poorly developed in the leaf-litter species of Phlaeothripinae including all the Urothripini. He (1992: 11) also indicated that the food resource is not a limiting factor in leaf-litter, so that the thrips probably do not compete with each other and thus do not need to produce large males. It is true that all urothripine species do not show the strong sexual dimorphism as well as allometric growth of males. However, the habitats of urothripine species are variable, not only the leaf-litter, as it appears from this investigation.

It is difficult to conceive of the way in which the specialized body form of these urothripines can be an adaptation to their habitats. The similarity of form implies a similarity of habitat, but they have been found during this investigation in leaf-litter, in grass tussocks, on dead leaves, on dead branches, and on dead palm fronds. Many other fungus-feeding phlaeothripine species also occur in these habitats without similar modifications, and so it seems possible that some factor other than habitat is involved.

Two Patterns of Distribution

These urothripine show two patterns of distribution in Japan. Two species, *japonicus* and *occidentalis*, are widespread but the other six species have more restricted distributions. *S. occidentalis* is found world-wide in the tropics and subtropics, and *japonicus* is widespread in East Asia from southern China to Japan, but the habitats of these two species are rather different as discussed above. MOUND (1970: 87–88 and 1972: 101) pointed out that certain thrips, like *occidentalis*, have been moved around the world by man in hay or straw, or in the ballast of sailing ships. But this only provides the mechanism; it does not explain why only a few species have become so widespread. Within Japan, *S. metaleucus* and *yaeyamensis* usually occur in leaf-litter, and *S. boninensis* and *B. ryukyuensis* usually occur in grass tussocks, but all four seem to have limited distributions. It may be that parthenogenesis is important in facilitating the widespread distribution of the first two species. Males are not known in *occidentalis* from any part of the world*, and males of *S. japonicus* were not found at the temperate region in Japan.

(* Recently, the author discovered several males of this species from southern

Thailand, and it will be reported elsewhere.)

Taxonomy

Baenothrips ryukyuensis sp. nov.

(Figs. 1, 5, 14)

Female (aptera). Bicolorous brown and yellowish white, with red hypodermal pigment laterally; head and prothorax brown, the rest of body yellowish white; mesothorax shaded with pale brown anteriorly and laterally, metathorax and abdomen shaded with pale brown laterally, this shading appears to be circular indistinct markings in abdominal segments II to IV or V; tube whitish yellow with extreme apex darker; forecoxae brown, concolorous with prothorax, midcoxae shaded pale brown, hindcoxae shaded with pale brown, slightly paler than midcoxae; fore- and midfemora yellowish white, hindfemora pale brown with base whitish; foretibiae yellowish white, mid- and hindtibiae pale brown with bases and apices whitish; all tarsi yellowish white; antennal segment I shaded with pale brown basally, segments II to VI yellowish white, segment VI shaded with pale brown distally, segments VII and VIII pale brown.

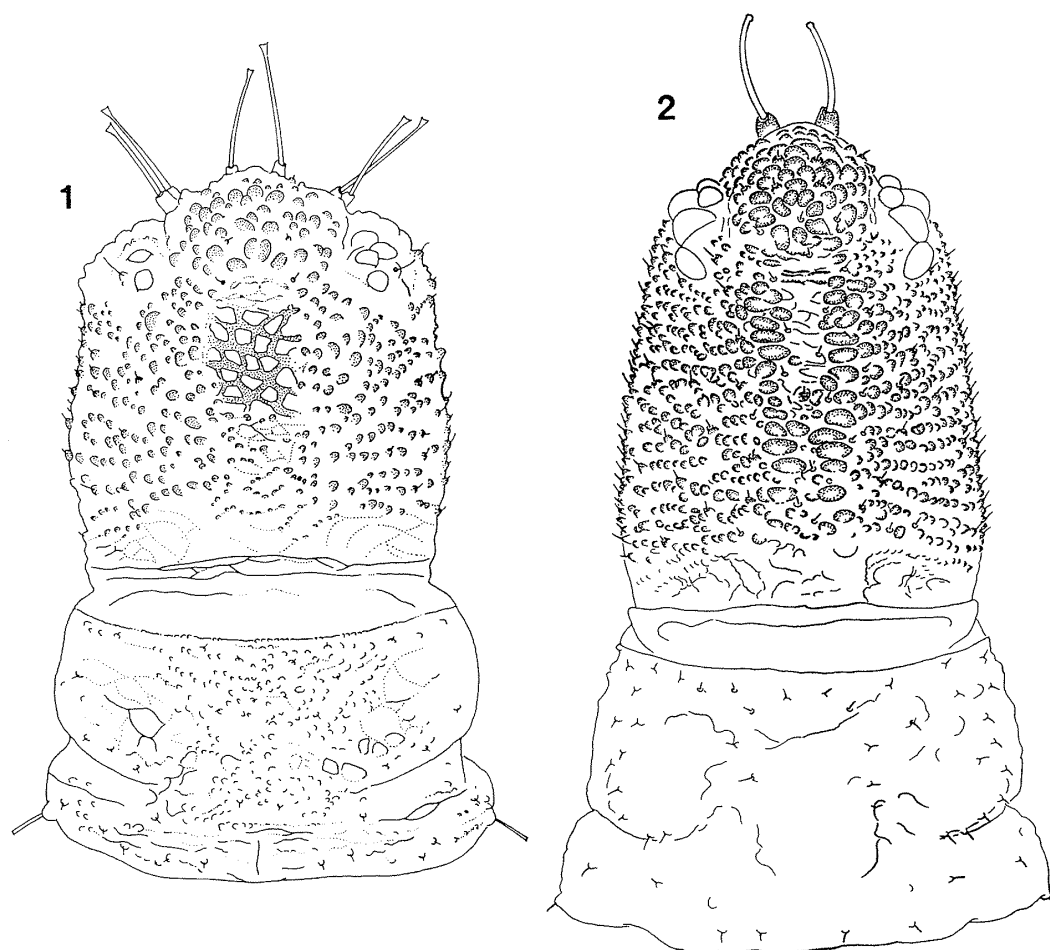
Head (Fig. 1) almost as long as broad or a little longer, cheeks rounded, broadest at basal one-third; dorsal surface generally with small tubercles, but median portion (vertex) with distinct raised reticulation; frontal costa more or less produced, arched in front of eyes, with three pairs of anterior cephalic setae, a median pair longer than two lateral pairs. Eyes small, each with about 10 ommatidia on dorsum. Antennae (Fig. 5) about 1.4 times as long as head.

Prothorax (Fig. 1) about 1.7–1.8 times as broad as long, 0.64–0.65 times as long as head; basantra(=praepectus) weak, but a little more distinct than that of *murphyi*. Metathoracic epimeral setae a little longer than prothoracic epimeral setae.

Intermediate abdominal terga each with a transverse row of 6–11 pairs of short setae medially, and each with three pairs of posteromarginal short setae. Tergum IX almost as long as head, 1.5–1.6 times as long as broad. Tube 1.95–2.10 times as long as head, 10.0–10.1 times as long as maximum width near apex. Anal setae 2.2–2.3 times as long as tube.

Measurements of holotype apterous female in μm . Total distended body length about 1600. Head length from anterior margin of eyes 148, from frontal costa 159, width across cheeks 152, width across eyes 135. Prothorax median length 103, width 182. Tergum IX length 153, width 102. Tube length 322, basal width 21.5, apical width 30.5. Antennal segments I to VIII length (width) as follows: 26 (28.5); 30 (31.5); 38 (23.5); 31.5 (24); 30 (23.5); 29 (21); 23.5 (13.5); 21 (10.5).

Length of setae. Inner pair of anterior cephalics 53–54, outer pairs 46–48. Prothoracic epimerals 19–21; metathoracic epimerals 23–24. Anals about 740.



Figs. 1–2. Head and prothorax, female. — 1, *Baenothrips ryukyuensis* sp. nov.; 2, *Stephanothrips boninensis* sp. nov.

Male (aptera). Colour and structure very similar to female. Head almost as long as broad, frontal costa with two pairs of cephalic setae, an inner pair and an outer pair; prothoracic epimeral setae almost as long as metathoracic epimeral setae.

Measurements of paratype apterous male in μm . Total distended body length 1150. Head length from anterior margin of eyes 113.5, from frontal costa 127, width across cheeks 124, width across eyes 110. Prothorax median length 79.5, width 145. Tergum IX length 108, width 80. Tube length 224, basal width 18, apical width 23.5. Antennal segments I to VIII length (width) as follows: 23.5 (26); 27 (26.5); 33 (21); 26.5 (27); 26.5 (21); 26 (18); 23 (14); 16 (10.5).

Length of setae. Inner pair of anterior cephalics 45–47, outer pairs 28–29. Prothoracic epimerals 15–16; metathoracic epimerals 15–16. Anals about 600.

Holotype ♀ (apt.). Japan, Okinawa-ken, Ishigaki-jima Is., Mt. Omoto-dake, on grass, 2–ix–1988 (SO).

Paratypes. Japan, Okinawa-ken, Ishigaki-jima Is.: 29 ♀ 6 ♂, collected with holotype; Mt. Omoto-dake, 1 ♀, on dead *Arenga engleri* frond, 11-ix-1988 (SO), 9 ♀, on dead *Arenga engleri* frond, 2-ix-1988 (SO), 6 ♀ 1 ♂, on dead leaves and branches, 27-viii-1989 (TN & SO), 63 ♀ 6 ♂, on grass (*Miscanthus* sp.), 11-iii-1990 (TN); 1 ♀, Takeda, on dead leaves and branches, 29-viii-1989 (SO); Takeda-rindou, 40 ♀ 10 ♂, on grass, 17-viii-1989 (TN & SO), 152 ♀ 21 ♂, on grass (*Miscanthus* sp.), 15-iii-1990 (TN), 251 ♀ 15 ♂, on grass (*Miscanthus* sp.), 18-i-1991 (SO); 3 ♀ 1 ♂, on dead leaves and branches, 17-viii-1989 (TN & SO); Urasoko-noudou, 2 km from Hoshino, 2 ♀, on dead branches, 13-ix-1989 (TN & SO), 1 ♀, 21-iii-1990, 1 ♀, 28-iii-1990 (TN); Mt. Banna-dake, 1 ♂, on dead leaves and branches, 10-ix-1988 (SO), 16 ♀ 8 ♂, on grass, 17-viii-1989 (TN & SO), 17 ♀ 6 ♂, on grass, 21-viii-1989 (TN & SO); Mt. Maese-dake, 22 ♀ 2 ♂, on grass, 10 ♀ 1 ♂, on dead *Arenga engleri* frond, 10-iii-1990 (TN); 1 ♀, Mt. Buzama-dake, 22-iii-1990 (TN). Iriomote-jima Is.: nr. Ohtomi, Nakamagawa-rindou, 2 ♂, leaf-litter, 19-vi-1988 (H. KARUBE), 2 ♀, on dead leaves, 3-ix-1988 (SO), 2 ♀, on dead leaves, 8-ix-1988 (SO), 1 ♂, leaf-litter, 12-x-1989 (TN); 54 ♀ 16 ♂, Upper Riv. Urauchi, nr. Mariudo-notaki, on grass, 5-ix-1988 (SO). Okinawa-hontou Is.: 1 ♀, Kunigami-son, Okuma, foot of Mt. Yonaha-dake, on dead *Casuarina* branches, 15-ix-1988 (SO); 1 ♀, campus of Ryukyu University, on grass, 6-iii-1990 (TN).

Non-paratypic material. Taiwan: 2 ♀ 1 ♂, Nantou-Hsien, Nanshanchi, on dead branches, 26-vii-1975 (SO).

Distribution. Japan—Ryukyu Islands (Okinawa-hontou Is., Ishigaki-jima Is. and Iriomote-jima Is.); Taiwan.

Remarks. Up to this time, nine *Baenothrips* species have been known in the world, in which four species have been found in Asia, *asper* (BOURNIER) from India and Taiwan, *indicus* (ANANTHAKRISHNAN) from India, *minutus* (ANANTHAKRISHNAN) from India, and *murphyi* (STANNARD) from West Malaysia and Thailand. They are very similar to one another. One species, *asper*, was originally described on three macropterous females from Angola, but has since been recorded on apterous individuals from India and Taiwan (ANANTHAKRISHNAN, 1966: 12, and KUDÔ, 1978: 169). Unfortunately, the author has not studied the specimens from Angola. However, according to the original description (BOURNIER, 1963: 81–85), Indian individuals are somewhat different. Moreover, there are many specimens collected from Southeast Asia (West Malaysia, Borneo, Thailand and Indonesia) other than the new species described above in the collection of Tokyo University of Agriculture, and these could barely be divided into some species on rather weak differences. As a result, it is very difficult to distinguish species in this group.

This new species is somewhat similar to *minutus*, but it can be distinguished from the latter by the following features: Head shorter, almost as long as broad; tubercles of head larger; with complete suture between antennal segments VII and VIII; tube a little longer, 1.95–2.10 times as long as head. A female recorded from Taiwan under the name of *asper* by KUDÔ (1978) may be conspecific with this species.

Stephanothrips boninensis sp. nov.

(Figs. 2, 6, 11, 15)

Female (aptera). Bicolourous brown and whitish yellow, head, pterothorax and intermediate abdominal segments scattered with red hypodermal pigments; head, pterothorax, abdominal segment I, midcoxae and midfemora brown, but extreme base of head paler; midtibiae brown basally, yellowish apically; hindfemora and hindtibiae shaded with pale brown; the rest of body and legs whitish yellow, but intermediate abdominal segments shaded with pale brown laterally, and tube with extreme apex darker; antennal segments I to IV whitish yellow, segments V and VI shaded with pale brown.

Head (Fig. 2) longer than broad, cheeks slightly widened towards base, but distinctly constricted basally; dorsal surface generally tuberculate, tubercles on median portion large; frontal costa distinctly produced, arched in front of eyes, with a pair of anterior cephalic setae. Eyes each with 5–6 ommatidia on dorsum. Antennae (Fig. 6) 1.1–1.2 times as long as head, six-segmented; segment III with indistinct sutures between morphological segments; segments V and VI (=morphological VII and VIII) separated, but closely and broadly joined. Maxillary stylets reaching eyes, 20–22 μm apart from each other, maxillary bridge undeveloped.

Prothorax (Fig. 2) weak, 1.55–1.60 times as broad as long, 0.64–0.65 times as long as head, epimeral setae minute; pronotum sculptured weakly. Meso- and metanotum well developed, generally tuberculated with small tubercles.

Tergum I distinct, generally tuberculated as metanotum; intermediate abdominal terga (Fig. 11) each with three pairs of posteromarginal setae, and each with a transverse row of 18–22 minute setae medially; tergum IX about 1.4 times as long as broad, shorter than head. Tube 1.72–1.76 times as long as head, 11.1–11.3 times as long as apical width. Anal setae almost twice the length of tube.

Measurements of holotype apterous female in μm . Total distended body length about 1800. Head length from anterior margin of eyes 179, from frontal costa 200, width across cheeks 156, across eyes 110. Prothorax median length 129, width 205. Tergum IX length 163.5, width 115.5. Tube length 348, basal width 24, apical width 31. Antennal segments I to VI length (width) as follows: 24 (29); 32 (34); 93 (26.5); 27.5 (20); 24 (15.5); 18.5 (10).

Length of setae. Anterior cephalics 48–52. Anals about 700.

Male (aptera). Colour and structure very similar to those of female. Maxillary stylets 37 μm apart from each other; prothorax 0.66–0.68 times as long as head, 1.8 times as broad as long; tergum IX 0.87–0.89 times as long as head, 1.45–1.50 times as long as broad; tube 1.49–1.53 times as long as head, 8.3–8.5 times as long as apical width; anal setae longer than twice the length of tube.

Measurements of paratype apterous male in μm . Total distended body length 1170. Head length from anterior margin of eyes 129, from frontal costa 143, width

across cheeks 116, across eyes 93. Prothorax median length 87, width 158. Tergum IX length 113.5, width 77. Tube length 216.5, basal width 21, apical width 26. Antennal segments I to VI length (width) as follows: 24 (26); 27 (29); 82 (23); 26 (19); 24 (14); 16 (10).

Length of setae. Anterior cephalics 47–50. Anals 560–570.

Holotype ♀ (apt.). Japan, Ogasawara Isls., Haha-jima Is., nr. Nakanotaira, on dead branches, 7-iii–1988 (SO).

Paratypes. Japan, Ogasawara Isls., Haha-jima Is.: 12 ♀ 2 ♂, collected with holotype; nr. Nakanotaira, 120 ♀ 35 ♂, on grass, 7-iii–1988 (SO), 6 ♀, on dead leaves, 7-iii–1988 (SO), 15 ♀, on dead *Livistona chinensis* frond (Palmae), 7-iii–1988 (SO); 4 ♀, nr. Okimura, Mt. Chibusa-yama, on dead leaves, 9-iii–1988 (SO); Okimura, 13 ♀, on dead leaves, 6-iii–1988 (SO), 3 ♀ 1 ♂, on grass, 9-iii–1988 (SO); 101 ♀ 13 ♂, nr. Minami-zaki, on grass, 5-iii–1988 (SO). Chichi-jima Is.: 1 ♀, Mt. Asahi-yama, on dead branches, 11-iii–1988 (SO).

Distribution. Japan—Ogasawara Isls. (Haha-jima Is. and Chichi-jima Is.).

Remarks. This species belongs to the group with a pair of anterior cephalic setae and reduced prothoracic epimeral setae. It is easily distinguished from the other members of the genus by the coloration.

Stephanothrips formosanus OKAJIMA

(Figs. 16)

Stephanothrips formosanus OKAJIMA, 1976; 404–406.

This species was originally described from Kenting National Park, southern end of Taiwan, based on a unique holotype female. Recently, the author found ten females listed below from Haha-jima Is. and Chichi-jima Is., Ogasawara Islands. Females from Ogasawara Islands have the third antennal segment (=morphological III to V) somewhat shorter than that of holotype. However, the remaining structures and coloration are very similar to each other, and they are considered conspecific.

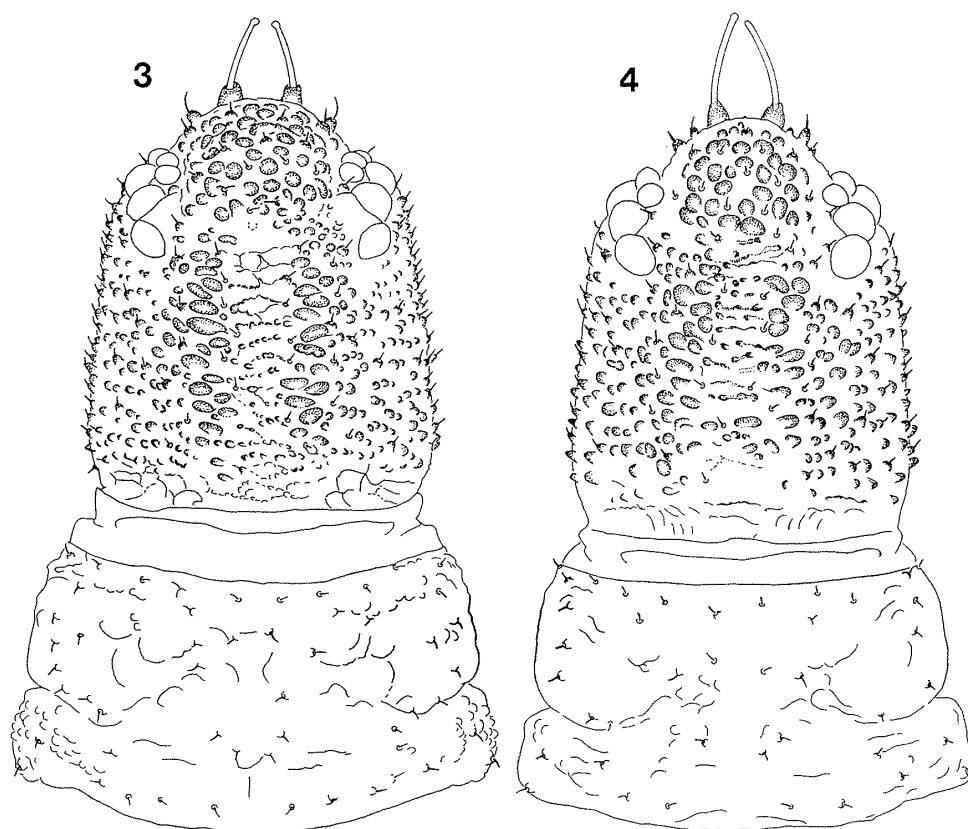
Material examined. Holotype ♀, Taiwan, Pintung Hsien, Kenting National Park, on dead *Phoenix*, 10-viii–1975 (SO). Japan, Ogasawara Isls.: 5 ♀, Haha-jima Is., Mt. Sakaigatake, on dead branches, 4-iii–1988 (SO); 4 ♀, Haha-jima Is., nr. Okimura, Mt. Chibusa-yama, on dead leaves, 9-iii–1988 (SO); 1 ♀, Chichi-jima Is., Mt. Mikazuki-yama, on dead branches, 10-iii–1988 (SO).

Distribution. Japan—Ogasawara Isls. (Haha-jima Is. and Chichi-jima Is.); Taiwan.

Stephanothrips metaleucus sp. nov.

(Figs. 3, 7, 9, 12, 17)

Female (aptera). Bicolourous brown and yellow, scattered with red hypodermal pigments laterally; head, pterothorax, abdominal segment I, fore- and midlegs

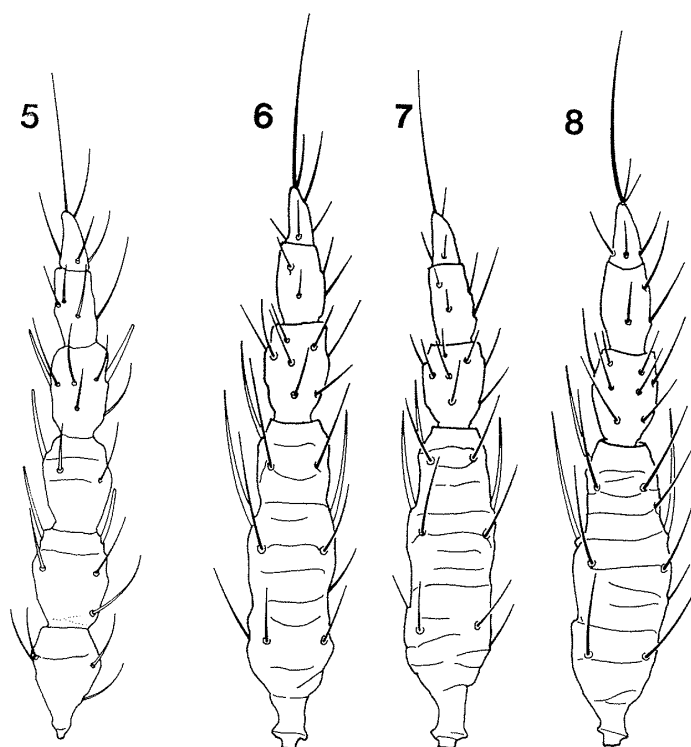


Figs. 3–4. *Stephanothrips* species, head and prothorax, female. — 3, *S. metaleucus* sp. nov.; 4, *S. yaeyamensis* sp. nov.

brown to dark brown; prothorax yellow, with lateral margins brown, shaded with pale brown at posterior one-third; abdominal segments II to IX yellow, intermediate segments shaded with pale brown laterally; tube yellow, with extreme apex darker; hindlegs pale brown, paler than midlegs; antennal segments I to III yellow, segments IV to VI pale brown, segment IV with base yellowish.

Head (Fig. 3) a little longer than broad, cheeks almost straight, slightly widened to base, but narrowed basally; dorsal surface generally tuberculate, tubercles on median portion large, but center of vertex irregularly reticulated with small warts; frontal costa slightly produced, arched in front of eyes, with a pair of anterior cephalic setae. Eyes each with 4–5 ommatidia on dorsum. Antennae (Fig. 7) 1.1–1.2 times as long as head, six-segmented; segment III with suture between morphological segments indistinctly, usually invisible; segments V and VI (=morphological VII and VIII) separated, but closely and broadly joined. Maxillary stylets reaching eyes, 44 μ m apart from each other in holotype, maxillary bridge very weakly developed.

Prothorax (Fig. 3) stout, about twice as broad as long, 0.55–0.57 times as long as head, epimeral setae minute, pronotum tuberculated weakly; ferna (=proba-



Figs. 5–8. Antenna (basal two segments are omitted) of *Baenothrips* and *Stephanothrips* species, female. — 5, *B. ryukyuensis* sp. nov.; 6, *S. boninensis* sp. nov.; 7, *S. metaleucus* sp. nov.; 8, *S. yaeyamensis* sp. nov.

sisternum) well developed, dark and stout. Meso- and metanotum (Fig. 9) well developed, sculptured with tuberculated lines.

Tergum I sculptured as metanotum; intermediate abdominal terga (Fig. 12) each with three pairs of posteromarginal setae, and each with a transverse row of 22–26 minute setae medially; tergum IX about 1.5 times as long as broad, shorter than head. Tube 1.30–1.37 times as long as head, 8.4–8.7 times as long as apical width. Anal setae almost twice as long as tube or a little longer.

Measurements of holotype apterous female in μm . Total distended body length about 1500. Head length from anterior margin of eyes 161, from frontal costa 182, width across cheeks 150.5, across eyes 120. Prothorax median length ? 103, width 216. Tergum IX length 156, width 104. Tube length 245, basal width 21.5, apical width 28.5. Antennal segments I to VI length (width) as follows: ? 26 (26); 32 (30); 97 (27); 28 (18.5); 24 (14); 16 (9).

Length of setae. Anterior cephalics 31–37. Anals 530–545.

Male (aptera). Colour and structures very similar to those of female. Foretarsus with an apical small hook-like inner tooth; abdominal segment IX 1.41–1.43 times as long as broad; tube 1.2–1.3 times as long as head, 7.4–7.8 times as long as apical width; anal setae much longer than twice the length of tube.

Measurements of paratype apterous male in μm . Total distended body length 1080. Head length from anterior margin of eyes 129, from frontal costa 142, width across cheeks 119, across eyes 97.5. Prothorax median length 84.5, width 158.5. Tergum IX length 108, width 76.5. Tube length 177, basal width 17, apical width 23. Antennal segments I to VI length (width) as follows: 24 (26); 26 (27); 80 (24); 24 (18.5); 24 (14); 13.5 (9).

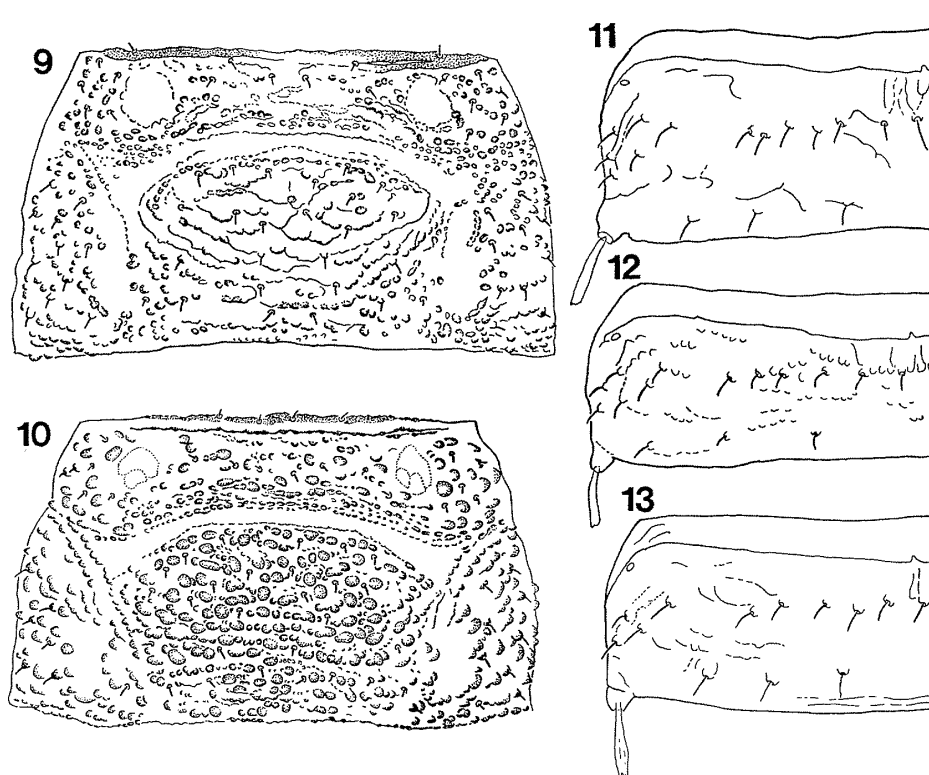
Length of setae. Anterior cephalics 24–26. Anals 530–540.

Holotype ♀ (apt.). Japan, Ogasawara Isls., Haha-jima Is., nr. Okimura, Mt. Kensaki-yama, leaf-litter, 10–iii–1988 (SO).

Paratypes. Japan, Ogasawara Isls., Haha-jima Is.: 89 ♀ 39 ♂, collected with holotype; 2 ♀, nr. Minami-zaki, on grass, 5–iii–1988 (SO); 5 ♀ 1 ♂, nr. Okimura, Mt. Chibusa-yama, on dead leaves, 9–iii–1988 (SO); 1 ♀, Okimura, on grass, 9–iii–1988 (SO).

Distribution. Japan—Ogasawara Isls. (Haha-jima Is.).

Remarks. This species also belongs to the group with a pair of anterior cephalic setae and reduced prothoracic epimeral setae, and is most similar to *japonicus*. However, it can easily be distinguished from *japonicus* by the following features: Prothorax yellow, with lateral margins brown, shaded with pale brown at pos-



Figs. 9–13. Meso- and metathorax (9–10) and left half of tergum IV (11–13) of *Stephanothrips* species, female. — 9, *S. metaleucus* sp. nov.; 10, *S. yaeyamensis* sp. nov.; 11, *S. boninensis* sp. nov.; 12, *S. metaleucus* sp. nov.; 13, *S. yaeyamensis* sp. nov.

terior one-third; pterothorax brown; fore- and midlegs brown to dark brown; antennae six-segmented, with complete suture between morphological segments VII and VIII; tube 1.30–1.37 times as long as head.

Stephanothrips yaeyamensis sp. nov.

(Figs. 4, 8, 10, 13, 18)

Female (aptera). Bicolourous brown and whitish yellow, with red hypodermal pigments in anterior portion of head, pterothorax and lateral portions of abdominal segments; head whitish yellow, frontal costa shaded with pale brown, vertex very weakly shaded with pale brown; prothorax and forelegs whitish yellow; pterothorax, abdominal segment I and midlegs brown to dark brown; abdominal segment II and hindlegs brown, a little paler than pterothorax and midlegs; intermediate abdominal segments yellow, shaded with brown medially and laterally, segment IX generally shaded with pale brown; tube yellow with extreme apex dark; antennal segments I to III whitish yellow, almost concolorous with head, segments IV to VI pale greyish brown.

Head (Fig. 4) much longer than broad, cheeks slightly widened to base, but constricted basally; dorsal surface tuberculated, median portion reticulated with small tubercles; frontal costa produced, arched in front of eyes, with a pair of anterior cephalic setae. Eyes each with 6–7 ommatidia on dorsum. Antennae (Fig. 8) 1.07–1.15 times as long as head, six-segmented; segment III with indistinct sutures between morphological segments; segments V and VI (=morphological VII and VIII) separated, closely and broadly joined. Maxillary stylets reaching eyes, 37 μm apart from each other in holotype, maxillary bridge undeveloped.

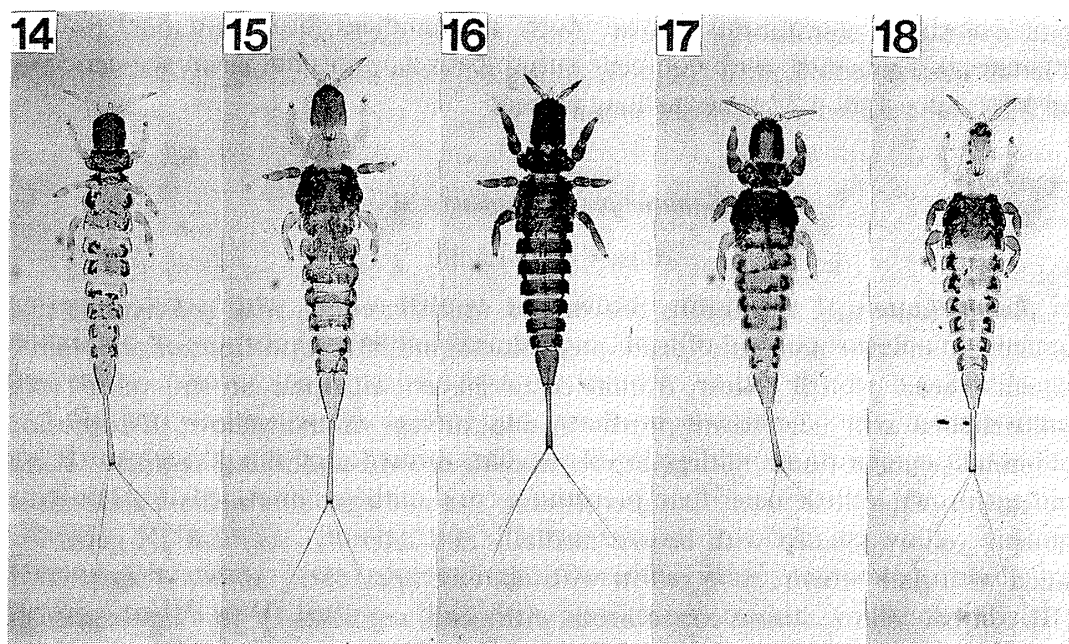
Prothorax (Fig. 4) weak, 1.85–1.95 times as broad as long, 0.56–0.58 times as long as head, epimeral setae minute; pronotum sculptured weakly. Meso- and metanotum (Fig. 10) stout, generally tuberculated with well developed tubercles.

Tergum I generally tuberculated as metanotum; intermediate abdominal terga (Fig. 13) each with three pairs of posteromarginal setae, and each with a transverse row of 18–23 minute setae medially; tergum IX 1.52–1.55 times as long as broad, shorter than head. Tube 1.40–1.42 times as long as head, 8.3–8.8 times as long as apical width. Anal setae much longer than twice the length of tube.

Measurements of holotype apterous female in μm . Total distended body length 1380. Head length from anterior margin of eyes 151, from frontal costa 172, width across cheeks 136, across eyes 115. Prothorax median length 98, width 189. Tergum IX length 145, width 95. Tube length 243, basal width 21, apical width 29. Antennal segments I to VI length (width) as follows: 28 (26); 29 (30); 79 (27); 26 (18.5); 24 (13.5); 18 (10.5).

Length of setae. Anterior cephalics 40–45. Anals 660–700.

Male (aptera). Colour and structures very similar to those of female. Tergum IX about 0.9 times as long as head, 1.41–1.43 times as long as wide; tube about



Figs. 14–18. *Baenothrips* and *Stephanothrips* species, female. — 14, *B. ryukyuensis* sp. nov.; 15, *S. boninensis* sp. nov.; 16, *S. formosanus* OKAJIMA; 17, *S. metaleucus* sp. nov.; 18, *S. yaeyamensis* sp. nov.

1.5 times as long as head, 7.8–8.0 times as long as apical width.

Measurements of paratype apterous male in μm . Total distended body length about 1100. Head length from anterior margin of eyes 124, from frontal costa 135, width across cheeks 113.5, across eyes 100. Prothorax median length ? 79, width 150. Tergum IX length 105, width 73. Tube length 187, basal width 18, apical width 24. Antennal segments I to VI length (width) as follows: 24 (24); 26 (26.5); 71 (25); 22 (18.5); 24 (14.5); 16 (11).

Length of setae. Anterior cephalics 26–27. Anals 550–580.

Holotype ♀ (apt.). Japan, Okinawa-ken, Ishigaki-jima Is., Urasoko-noudou, 2 km from Hoshino, leaf-litter, 6-x-1989 (TN).

Paratypes. Japan, Okinawa-ken, Ishigaki-jima Is.: 145 ♀ 138 ♂, collected with holotype; Urasoko-noudou, 2 km from Hoshino, leaf-litter, 10 ♀ 9 ♂, 2-ix-1989, 18 ♀ 35 ♂, 13-ix-1989 (TN & SO), 75 ♀, 143 ♂, 24-ix-1989 (TN); 2 ♀, nr. Hirakubo, Mt. Ara-dake, leaf-litter, 16-iii-1990 (TN); 38 ♀ 22 ♂, Mt. Fukaimoto-dake, leaf-litter, 13-i-1991 (SO); 9 ♀ 7 ♂, Mt. Banna-dake, leaf-litter, 3-x-1989 (TN).

Distribution. Japan—Ryukyu Islands (Ishigaki-jima Is.).

Remarks. This species also belongs to the group with a pair of anterior cephalic setae and reduced prothoracic epimeral setae, and is most closely related to *leucocephalus* OKAJIMA from the Philippines. However, it differs from *leucocephalus* in the long anterior cephalic setae and reticulated vertex.

Key to Japanese Urothripine Species

1. Antennal segments III, IV and V separated; median dorsal setae of tube less than two-thirds as long as lateral two pairs... *Baenothrips ryukyuensis* sp. nov.
- Antennal segments III, IV and V fused or broadly joined into one segment; median dorsal setae on tube a little shorter than lateral two pairs 2
2. Head with three pairs of anterior cephalic setae 3
- Head with one pair of anterior cephalic setae 5
3. Foretarsus with an external hamulus or hook
..... *Stephanothrips occidentalis* HOOD & WILLIAMS
- Foretarsus unarmed 4
4. Vertex reticulated *Stephanothrips miscanthi* KUDÔ
- Vertex tuberculated *Stephanothrips formosanus* OKAJIMA
5. Antenna five-segmented, with incomplete suture between morphological antennal segments VII and VIII *Stephanothrips japonicus* SAIKAWA
- Antenna six-segmented, with complete suture between morphological antennal segments VII and VIII 6
6. Head and prothorax whitish yellow; pterothorax and abdominal segment I brown to dark brown, abdominal segment II brown, intermediate abdominal segments yellow; forelegs whitish yellow, midlegs and hindlegs brown to dark brown, hindlegs a little paler than midlegs; anal setae much longer than twice the length of tube; from Ryukyu Islands (Ishigaki-jima Is.)
..... *Stephanothrips yaeyamensis* sp. nov.
- Head brown to dark brown; from Ogasawara Islands 7
7. Prothorax weak, whitish yellow; forelegs whitish yellow; tube 1.72–1.76 times as long as head in female, 1.49–1.53 times in male
..... *Stephanothrips boninensis* sp. nov.
- Prothorax stout, yellow, with lateral margins brown, shaded with pale brown at posterior one-third; forelegs brown to dark brown; tube 1.30–1.37 times as long as head in female, 1.2–1.3 times in male
..... *Stephanothrips metaleucus* sp. nov.

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